



## DEMONSTRATION PROJECT OVERVIEW

### DC POWERING ARCHITECTURE FOR DATA CENTERS: DC POWERING AT THE FACILITY LEVEL

**What it is:** Joint industry & California Energy Commission sponsored demonstration  
**When:** April 2006 to September 2006  
**Where:** Sun Microsystems, Newark, CA  
**More info:** Scheduled open house and "virtual" open house June – July 2006 see <http://hightech.lbl.gov/>

#### BACKGROUND

An alternative approach to conventional AC power uses a DC power distribution scheme throughout a data center. Most data center server racks are not currently powered this way, but with the advent of servers on the market that can operate with either AC or DC, it is possible to use the DC powering approach, thus eliminating extra power conversion steps and losses. Other benefits include reduced cooling needs, higher equipment densities, and reduced heat-related failures.

#### DEMONSTRATION GOAL AND OBJECTIVES

A stakeholder group has been formed by industry and the CEC to investigate:

1. Whether or not DC powered server(s) and/or server racks can provide the same level of functionality and computing performance when compared to similarly configured and operating servers (and/or server racks) containing AC powered server(s), as measured with industry standard measurement devices and software tools.
2. Document any efficiency gains from the elimination of multiple conversion steps in the delivery of DC power.
3. Feasibility for both facility-level as well as rack-level DC conversion and delivery.
4. Identify issues/best practices and make recommendations for implementation.

#### FACILITY-LEVEL DEMONSTRATION

This demonstration project focuses on DC conversion at the Data Center (or Facility) level. This approach converts the facility's high-voltage AC into high-voltage DC and delivering it to the equipment racks via high-voltage DC buss (the possible DC voltages under consideration range from 350V up to 500V – the current consensus is at 380 VDC). Further voltage conversion/step down can be handled at the rack or equipment level as needed. This approach concentrates the DC conversion into one unit/location for the whole facility, removing the AC to DC conversion function from the equipment. Figures 1 and 2 contain representations of this option.

Concurrently underway is a demonstration of a rack-level DC distribution – please contact one of the project contacts below to get additional information on these efforts.

Some major advantages of this Facility-Level option include:

- Only one rectifier stage is needed for DC conversion
- Possible efficiency gains from the reduction of multiple conversion steps
- Allows for better cooling management

Considerations regarding this approach:

- Suitable only for new server rack configurations
- Requires data center infrastructure changes.

#### PROJECT PARTICIPANTS

A listing of project participants is provided below. A complete listing is available from the project contacts.

- |                                    |                                     |                               |
|------------------------------------|-------------------------------------|-------------------------------|
| ▪ Alindeska Electrical Contractors | ▪ Hewlett Packard                   | ▪ Rosendin Electric Inc.      |
| ▪ Baldwin Technologies             | ▪ Intel                             | ▪ SatCon Power Systems        |
| ▪ CCG Facility Integration         | ▪ Industrial Electric Manufacturing | ▪ Square D/Schneider Electric |
| ▪ Cisco Systems                    | ▪ Emerson Network Power             | ▪ Sun Microsystems            |
| ▪ Cupertino Electric               | ▪ Morrison Hershfield Corporation   | ▪ TDI Power                   |
| ▪ Dranetz-BMI                      | ▪ NTT Facilities                    | ▪ Universal Electric Corp.    |
| ▪ Dupont Fabros                    | ▪ Nextek Power Systems              | ▪ Verizon Wireless            |
| ▪ EDG2, Inc.                       | ▪ Pentadyne Power Corporation       |                               |
| ▪ EYP Mission Critical             | ▪ RTKL                              |                               |

#### Project Contacts

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Diagram illustrating a 2U server rack power distribution system. The rack contains two rows of server bays, each with four slots. The top row is labeled 'CB' and the bottom row is labeled 'CB'. A central vertical column contains two 'DC PDU' units. To the left of the rack are two 'DC UPS' units, labeled 'DC UPS1' and 'DC UPS2'. To the right of the rack are two 'Server' units, each containing a 'DC/DC' converter and labeled 'Server voltages' and 'PSU Server'. The diagram shows power flow from the UPS units through the DC PDUs to the server bays and then to the server units. A red arrow points to the top of the rack with the label '380V'.

Source: BTI

